



Tennessee Valley Authority, Post Office Box 2000, Spring City, Tennessee 37381

February 9, 2018

10 CFR 50.73

ATTN: Document Control Desk  
U.S. Nuclear Regulatory Commission  
Washington, D.C. 20555-0001

Watts Bar Nuclear Plant, Unit 2  
Facility Operating License No. NPF-96  
NRC Docket No. 50-391

Subject: **Licensee Event Report 391/2017-006-00, Manual Reactor Trip in  
Response to Indication of Multiple Dropped Control Rods**

This submittal provides Licensee Event Report (LER) 391/2017-006-00. This LER provides details concerning a manual reactor trip after control room staff observed multiple dropped control rods. This condition is being reported as a system actuation in accordance with 10 CFR 50.73(a)(2)(iv)(A).

There are no regulatory commitments contained in this letter. Please direct any questions concerning this matter to Kim Hulvey, WBN Licensing Manager, at (423) 365-7720.

Respectfully,

A handwritten signature in black ink, appearing to read "Paul Simmons", is written over a horizontal line.


Paul Simmons  
Site Vice President  
Watts Bar Nuclear Plant

Enclosure  
cc: See Page 2

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cc (Enclosure):

NRC Regional Administrator - Region II  
NRC Senior Resident Inspector - Watts Bar Nuclear Plant

<b>NRC FORM 366</b> (04-2017)		<b>U.S. NUCLEAR REGULATORY COMMISSION</b>			<b>APPROVED BY OMB: NO. 3150-0104</b>		<b>EXPIRES: 03/31/2020</b>			
 <b>LICENSEE EVENT REPORT (LER)</b>					Estimated burden per response to comply with this mandatory collection request: 80 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the Information Services Branch (T-2 F43), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by e-mail to Infocollects.Resource@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.					
<b>1. FACILITY NAME</b> Watts Bar Nuclear Plant, Unit 2					<b>2. DOCKET NUMBER</b> 05000391		<b>3. PAGE</b> 1 OF 5			
<b>4. TITLE</b> Manual Reactor Trip in Response to Indication of Multiple Dropped Control Rods										
<b>5. EVENT DATE</b>			<b>6. LER NUMBER</b>			<b>7. REPORT DATE</b>			<b>8. OTHER FACILITIES INVOLVED</b>	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO.	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
12	11	2017	2017	- 006	- 00	02	09	2018	N/A	N/A
<b>9. OPERATING MODE</b>			<b>11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check all that apply)</b>							
1			<input type="checkbox"/> 20.2201(b)		<input type="checkbox"/> 20.2203(a)(3)(i)		<input type="checkbox"/> 50.73(a)(2)(ii)(A)		<input type="checkbox"/> 50.73(a)(2)(viii)(A)	
			<input type="checkbox"/> 20.2201(d)		<input type="checkbox"/> 20.2203(a)(3)(ii)		<input type="checkbox"/> 50.73(a)(2)(ii)(B)		<input type="checkbox"/> 50.73(a)(2)(viii)(B)	
			<input type="checkbox"/> 20.2203(a)(1)		<input type="checkbox"/> 20.2203(a)(4)		<input type="checkbox"/> 50.73(a)(2)(iii)		<input type="checkbox"/> 50.73(a)(2)(ix)(A)	
			<input type="checkbox"/> 20.2203(a)(2)(i)		<input type="checkbox"/> 50.36(c)(1)(i)(A)		<input checked="" type="checkbox"/> 50.73(a)(2)(iv)(A)		<input type="checkbox"/> 50.73(a)(2)(x)	
97			<input type="checkbox"/> 20.2203(a)(2)(ii)		<input type="checkbox"/> 50.36(c)(1)(ii)(A)		<input type="checkbox"/> 50.73(a)(2)(v)(A)		<input type="checkbox"/> 73.71(a)(4)	
			<input type="checkbox"/> 20.2203(a)(2)(iii)		<input type="checkbox"/> 50.36(c)(2)		<input type="checkbox"/> 50.73(a)(2)(v)(B)		<input type="checkbox"/> 73.71(a)(5)	
			<input type="checkbox"/> 20.2203(a)(2)(iv)		<input type="checkbox"/> 50.46(a)(3)(ii)		<input type="checkbox"/> 50.73(a)(2)(v)(C)		<input type="checkbox"/> 73.77(a)(1)	
			<input type="checkbox"/> 20.2203(a)(2)(v)		<input type="checkbox"/> 50.73(a)(2)(i)(A)		<input type="checkbox"/> 50.73(a)(2)(v)(D)		<input type="checkbox"/> 73.77(a)(2)(i)	
			<input type="checkbox"/> 20.2203(a)(2)(vi)		<input type="checkbox"/> 50.73(a)(2)(i)(B)		<input type="checkbox"/> 50.73(a)(2)(vii)		<input type="checkbox"/> 73.77(a)(2)(ii)	
					<input type="checkbox"/> 50.73(a)(2)(i)(C)		<input type="checkbox"/> OTHER		Specify in Abstract below or in NRC Form 366A	
<b>12. LICENSEE CONTACT FOR THIS LER</b>										
<b>LICENSEE CONTACT</b> Anthony Pate, Licensing Program Manager								<b>TELEPHONE NUMBER (Include Area Code)</b> 423-365-3472		
<b>13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT</b>										
CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	
B	AA	CBD	WEST	Y						
<b>14. SUPPLEMENTAL REPORT EXPECTED</b> <input type="checkbox"/> YES (If yes, complete 15. EXPECTED SUBMISSION DATE) <input checked="" type="checkbox"/> NO					<b>15. EXPECTED SUBMISSION DATE</b> MONTH:    DAY:    YEAR:					
<b>ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)</b> <p>On December 11, 2017 at 0857 Eastern Standard Time (EST), the Watts Bar Nuclear Plant Unit 2 reactor was manually tripped after Operators observed multiple dropped control rods. All control and shutdown bank rods inserted properly in response to the manual reactor trip. All safety systems including Auxiliary Feedwater actuated as designed. The plant was stabilized with decay heat removal through Auxiliary Feedwater and the Steam Dump System.</p> <p>An intermittent electrical connection between a rod control power cabinet card and the power cabinet backplane power supply caused a rod control malfunction with control bank A group 2 control rods. The malfunction resulted in four control rods dropping into the reactor core. As a corrective action, all five control rod power cabinets had a 100 percent inspection of backplane connectors on the card cages. Backplane connectors were reformed and aligned as necessary to attain suitable electrical and mechanical connection. Additionally, all associated circuit cards for the power cabinets had their connectors re-formed with a precision tool.</p> <p>This event is being reported under 10 CFR 50.73(a)(2)(iv)(A) as safety system actuations of the Reactor Protection System and Auxiliary Feed Water System.</p>										

**LICENSEE EVENT REPORT (LER)  
CONTINUATION SHEET**

Estimated burden per response to comply with this mandatory collection request: 80 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the Information Services Branch (T-2 F43), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by e-mail to [Infocollects.Resource@nrc.gov](mailto:Infocollects.Resource@nrc.gov), and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

1. FACILITY NAME	2. DOCKET NUMBER	3. LER NUMBER		
		YEAR	SEQUENTIAL NUMBER	REV NO.
Watts Bar Nuclear Plant, Unit 2	05000391	2017	- 006	- 00

**NARRATIVE****I. PLANT OPERATING CONDITIONS BEFORE THE EVENT**

Watts Bar Nuclear Plant (WBN) Unit 2 was in Mode 1 at 97 percent rated thermal power.

**II. DESCRIPTION OF EVENT****A. Event Summary**

On December 11, 2017 at 0857 Eastern Standard Time (EST), the WBN Plant Unit 2 reactor was manually tripped after Operators observed multiple dropped control rods. All control and shutdown bank rods inserted properly in response to the manual reactor trip. All safety systems including Auxiliary Feedwater (AFW) {EIS:BA} actuated as designed. The plant was stabilized with decay heat removal through AFW and the Steam Dump System {EIS:JI}. An intermittent connection between a rod control power cabinet {EIS:CBD} circuit card and the power cabinet backplane power supply in the Control Rod Drive System {EIS:AA} caused a rod control malfunction with control bank A group 2 control rods. The malfunction resulted in four control rods dropping into the reactor core. As a corrective action, all five control rod power cabinets had a 100 percent inspection of backplane connectors on the card cages. Backplane connectors were reformed and aligned as necessary to attain suitable electrical and mechanical connection. Additionally, all associated circuit cards for the power cabinets had their connectors re-formed with a precision tool.

This event is being reported under 10 CFR 50.73(a)(2)(iv)(A) as safety system actuations of the Reactor Protection System and Auxiliary Feed Water System.

**B. Inoperable Structures, Components, or Systems that Contributed to the Event**

Rod Control Solid State Power Cabinet (2AC) had several backplane connector pins with less than optimal connection with control cards. Intermittent connection in one of the three stationary control cards associated with control bank A group 2 resulted in four dropped control rods.

**C. Dates and Approximate Times of Occurrences**

Date	Time (EST)	Event
12/11/17	0857	Unit 2 reactor manually tripped due to multiple dropped rods (Control Bank A group 2). Entered 2-E-0 Reactor Trip or Safety Injection
12/11/17	0904	Transitioned to 2-ES-0.1 Reactor Trip Response
12/11/17	0932	Transitioned to 2-GO-5 Unit Shutdown From 30% Reactor Power to Hot Standby
12/11/17	1106	NRC Event Notification 53112 complete for Reactor Trip.

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**NARRATIVE****D. Manufacturer and Model Number of Components that Failed During the Event**

The event was caused by intermittent connection issues between the stationary control cards and the power cabinet backplane connector in Westinghouse designed power cabinet 2AC. All control cards that could have caused the event were subsequently tested by Westinghouse. There were no confirmed card failures.

**E. Other Systems or Secondary Functions Affected**

No other systems or secondary functions were affected.

**F. Method of discovery of each Component or System Failure or Procedural Error**

The intermittent connection issue was discovered during troubleshooting after the manual reactor trip.

**G. Failure Mode and Effect of Each Failed Component**

During troubleshooting in the 2AC power cabinet, several backplane connector pins were found to have intermittent connections. One of the suspect pins supplies +24 volts DC to hold control bank A group 2 control rods stationary. Without this voltage, the rods would drop into the core.

**H. Operator Actions**

There were no complications with the manual reactor trip. The normal expected trip response procedure progression was utilized to stabilize the plant.

**I. Automatically and Manually Initiated Safety System Responses**

All automatic and manual safety systems responded as designed.

**III. CAUSE OF THE EVENT****A. The cause of each component or system failure or personnel error, if known.**

Based on results of troubleshooting and internal operating experience, the cause for the four dropped control rods was an intermittent connection in one of the three stationary control cards associated with control bank A group 2 rods.

**B. The cause(s) and circumstances for each human performance related root cause.**

The event was not attributed to human performance.

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**NARRATIVE****IV. ANALYSIS OF THE EVENT**

The WBN Plant Unit 2 reactor was manually tripped at 0857 (EST) on December 11, 2017 in accordance with 2-AOI-2, Malfunction of Rod Control System, due to multiple dropped control rods. All control and shutdown bank rods inserted properly in response to the manual reactor trip. The plant was promptly stabilized in Mode 3 with decay heat removal through the Steam Dump System. Troubleshooting revealed intermittent connections in one of the three stationary control cards which caused a loss of +24 volts DC to the firing card thereby resulting in the four dropped rods.

**V. ASSESSMENT OF SAFETY CONSEQUENCES**

During the event and subsequent recovery actions, there was no loss of safety systems, structures or components. The Auxiliary Feedwater system started as expected and remained available to remove decay heat after the reactor trip. Other plant systems functioned as required following the manual reactor trip. Control room operators responded appropriately by manually tripping the reactor as required by procedure. The reactivity effects during this event had no impact on the safety of the core and thus, the event was determined to be of low safety significance.

- A. Availability of systems or components that could have performed the same function as the components and systems that failed during the event

All safety systems operated as designed during this event.

- B. For events that occurred when the reactor was shut down, availability of systems or components needed to shutdown the reactor and maintain safe shutdown conditions, remove residual heat, control the release of radioactive material, or mitigate the consequences of an accident

Not Applicable.

- C. For failure that rendered a train of a safety system inoperable, an estimate of the elapsed time from the discovery of the failure until the train was returned to service

Not applicable.

**VI. CORRECTIVE ACTIONS**

This event was entered into the Tennessee Valley Authority (TVA) Corrective Action Program and is being tracked under Condition Report (CR) 1367005.

- A. Immediate Corrective Actions

All five control rod power cabinets had a 100 percent inspection of backplane connectors on the card cages. Backplane connectors were reformed and aligned as necessary to attain suitable electrical and mechanical connection. Circuit cards in power cabinet 2AC were replaced. Additionally, all associated circuit cards for the power cabinets had their connectors re-formed with a precision tool.

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**NARRATIVE****B. Corrective Actions to Prevent Recurrence or to Reduce Probability of Similar Events Occurring in the Future**

Long term corrective action to replace the card cage backplane connectors will be entered into Plant Health Committee for future consideration.

**VII. PREVIOUS SIMILAR EVENTS AT THE SAME SITE**

LER 2017-004 documents a rod control malfunction for WBN Unit 2 that occurred on July 25, 2017. During a reactor start-up, two associated control rod group demand position indicators deviated greater than 2 steps from each other. In accordance with Technical Requirement 3.1.7, Position Indication System, Shutdown, with one or more group demand position indicators inoperable, the reactor trip breaker are to be opened immediately. Operations personnel opened the reactor trip breakers immediately by initiating a manual trip of the Reactor Protection System. The rod control demand indication deviation was determined to be caused by a failed logic card in the rod control system.

While both of these events are associated with the Rod Control System, they are different in that one involved a circuit card failure and the other an intermittent connection issue between the card and connector.

**VIII. ADDITIONAL INFORMATION**

None.

**IX. COMMITMENTS**

None.